

A COMPANION TO THE
L A D I E S
D I A R Y,
FOR THE YEAR 1780.

CONTAINING
ÆNIGMAS, REBUSSES,
MATHEMATICAL ESSAYS,
QUESTIONS AND SOLUTIONS, &c.

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L O N D O N,

Printed for T. CARNAN, in St. Paul's Church-Yard.

ANSWERS to the QUERIES, REBUSES, &c. in Last Year's
DIARY.

Query I. Answered by Caput Mortuum.

IN the Vulgate translation, the text in question is rendered quite different; the giants are described as *groaning under the waters*, "*Ecce gigantes gemunt sub aquis*", which is partly followed in Taverner's Bible, "The giauntes and worthie that are slayne, and lye under the world, &c." These giants or *Rephaim* are frequently mentioned in the writings of the Hebrews. In the Book of Proverbs, ix. 18. they are said to be the inhabitants of hell; the Vulgate translation is, *Et ignoravit quod ibi sint gigantes*. In Isaiah's description of the downfall of the king of Babylon, hell is represented as meeting him at his coming, and stirring up the *Rephaim* for him, who shall say unto him, *Art thou also become weak as we? Art thou become like unto us?* Isaiah xiv. 9. & seq. *Infernus. — Suscitavit tibi gigantes. Vulg.*

That the Heathens borrowed their mythology from the Jews and Egyptians seems indisputable; the histories of Noah and Deucalion; of the Tower of Babel, and the giants piling mountains one upon another, when they waged war with the gods, if compared, are evident proofs of this.—When Jupiter conquered the giants, the Island of Sicily was upon *Enceladon*, or *Typhon*, whose breath was supposed to cause the volcano in that island, and *Virgil* describes him, as groaning and bellowing at the time of an eruption; might not this fable of the Greeks have been borrowed from the expression in Job?

The sense of the verse, as it stands in our Bible, seems not very clear. In Cranmer's Bible, as it is called, printed in 1540, it runs thus, "Are not deed thynges shapen under the waters: and thynges by the waters side?" Here, indeed, it may signify the corallines and other marine productions; but what connection is there between such productions and *giants groaning under the waters*?—If we suppose that giants are meant by the *inhabitant of the waters*, then the dead things formed may signify islands, which, as history informs us, have sometimes risen in the sea at the time of an earthquake: but this is a forced explanation.

Perhaps it would be in vain to endeavour to clear up this, or any other dubious expression in the Bible, by examining any old version now extant. *Renaudotus* says, that the Syriac version is the oldest of all the Oriental ones. Most of the Latin versions before the year 380 were translated from the Greek; and St. Jerome says, that in his time there were almost as many different translations as books, and this induced him to undertake a new version from the Hebrew, which he partly performed, and revised the remainder about the year 406; this is the Vulgate now in use, and approved of by the council of Trent as the most authentic.

Query

Answers to Queries, Rebusses, &c.

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Query II. Answered by Caput Mortuum.

I am afraid the proposer is not sufficiently informed with regard to the summers and weather in England; I believe, upon examination, the seasons, &c. taking many years together, are nearly the same as formerly.—“If Montpelier is not the salutary spot it used to be,” there seem to be but two causes that could affect it, these are *subterraneous heats*, and a *difference in cultivation*; that an increase or diminution in the *first* may cause an alteration in the climate is evident; and that an alteration may be produced by the *latter* may be gathered from Dr. Priestley, and those who have written on vegetable statics, and the influence of the air on vegetation.

Query III. Answered by Mr. John Clarke of Lincoln.

Father Daniel relates, that hats became in use in the time of Charles II. about 1449; but the *Dictionnaire des Origines*, which is more to be depended upon, tells us, that they were not worn till the time of Charles VI. when they were used by the nobility when they rode a hunting.

Query IV. Answered by Mr. Alexander Rowe.

The greediness of Eli's sons was sufficient to make them procure the most convenient flesh-hook for the purpose mentioned; which being composed of three teeth, and the priest's servant was to drive it into the pot only once: hence it is evident, that each tooth was barbed, and that the hook generally brought up three pieces of flesh at one drawing, there being many in the pot at the same time; which might be farther confirmed, if necessary, from the covetousness and gluttony of the modern clergy; “For priests of all religions are the same.”

Query V. Answered by Caput Mortuum.

Take a razor or knife, and heat it till it is as warm as the breath, and then the experiment fails; the reason is obvious; as the breath contains much moisture, when it meets with a body colder than itself that moisture is condensed, and this is the cause why the breath is so discernable in frosty weather; now if we breathe upon any fine polished, reflecting surface, colder than the breath, the moisture thereby condensed, becomes a kind of cover, and consequently visible; this cannot be the case when the body is sufficiently warm, for then no condensation can take place.

That the evaporation of so very small a quantity of moisture must be performed almost suddenly, may be easily conceived by a comparison with Dr. Halley's experiments, who found that the common evaporation of water amounts to about one fifth of an inch *per diem*, and we may safely affirm, that the evaporation in question, would not exceed that quantity, were it to continue for the same space of time. This circumstance must also happen if we breathe upon bodies *not polished*, but that is the very reason why we do not perceive it.

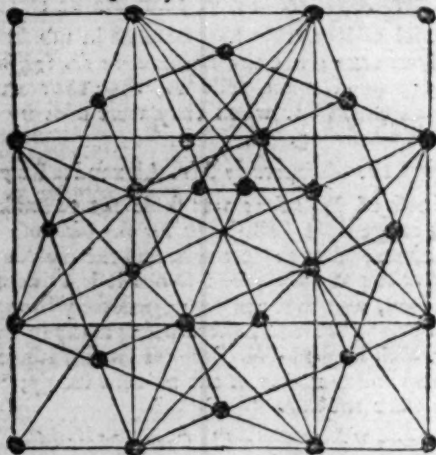
The Ladies Diary.

ANSWERS to the ENIGMAS in the last Year's DIARY.

- | | |
|---------------------|--------------|
| I. The letter O | VI. Chair |
| II. Goodnature | VII. Lock |
| III. Dart, or Arrow | VIII. Hare |
| IV. Nobody | Prize. Comb. |
| V. Oven | |

Answer to the Paradoxical Problem, with a new one proposed, by Mr. John Board, of Little-Town, Devonshire.

Friend *Silcock*, your trees I've endeavour'd to place,
 Their numbers and rows you may easily trace :
 But make the same number of rows, if you please,
 When out of the plan you have taken two trees.



All the Rebusses answered by Miss Elizabeth Cockbill.
 I've followed my nose till I've got a sad cough, IV. I. Reb.
 And I think like the de'el 'tis a foe bad enough, V.
 Like a bladder it puffs me ; this filthy disaster II. III.
 Has try'd all the skill of the quacks of Manchester. VI. Acr.

The same answered by Mr. J. Langdale.
 A cough is a teasing companion I'll swear, I. Reb.
 And a louse the companion of puff'd-up Monsieur, III. II.
 The nose to be sure we're obliged to follow ; V.
 The devil's a damnable fierce wicked fellow ;
 And of towns that for trade and for riches the best are,
 There are few can surpass, or compare with Manchester. VI.

The same answered by Mr. Alex. Rowe, of Reginnis, Cornwall.
 When Punch and Joan at Manchester were acting with their
 puppets, VI.
 In came a devilish fellow then, and call'd them fools and block-
 heads ; V.
 Cough'd,

Answers to Queries, Rebusses, &c.

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Cough'd, blow'd his *nose*, and threw the *filth* upon poor punch we find,

I. IV. III.

And swore his shows were full as light as *bladders* fill'd with wind.

II.

General Answer, by Miss Eliz. Parker, of Norton, Derbyshire.

Such a *de'el* of a *cough* I got the last week,

V. I. Reb.

My *nose* so obstructed I scarcely could speak :

IV.

The stone in the *bladder*, O *filthy* disaster,

II. III.

That I for relief must apply to *Manchester* !

Acrostic.

Then John *comb* my horse both his tail and his mane,

Pr. Enig.

And let me set off, for I'm tortur'd with pain.

Answers were also given by several others.

General Solution to the Enigmas, by Miss Eliz. Cockbill ; addressed to the Correspondents of the Ladies Diary.

Excuse my lays, ye tuneful nymphs and swains,

Enroll'd by fame for your unrivall'd strains ;

Whilst Heliconian nymphs, on lapsed wing,

I. Enig.

Your brows to grace do laurel *ringlets* bring ;

To fill your annual songs with sacred fire,

II.

Good-natured Phœbus deigns the warbling lyre ;

Whilst from Olympus' high embow'ring crown,

III.

On you Minerva darts her wisdom down.

On these sweet plains, kind bards, I'll make my care,

VIII.

To trace your footsteps as I've trac'd the *bare* ;

Whilst your examples, bright as *oven's* flame,

V.

Shall be my poem to the *seat* of fame.

VI.

Delia, with *comb*, her *locks* most artful curl'd,

VII. Prize.

Then play'd Phaëton, and enflam'd the world ;

So your accomplishments, excell'd by *none*,

IV.

Secure the conquests, by your beauty won ;

Then while th' admiring world with rapture warms,

At your productions and unequal'd charms ;

Like you I'll strive t' initiate my name,

And stand recorded in the lists of Fame.

Ingenious Answers to the Queries, Rebusses, Enigmas, &c. have been received from Miss Lee, Miss Greville, Beatrice, and Messrs. Clarke, Rogers, Rowe, Board, Silcock, Pepys, Penson, Langdale, Metcalfe, &c. The Prize of Ten Diaries fell to the lot of Miss Cockbill, who is desired to send for them to the Publisher.

New QUERIES, REBUSSES, &c. to be answered in next Year's Diary.

An ACROSTICAL REBUS, by Miss Cockbill.

He who attempted to cornute great Jove,

She who prov'd trait'refs to win Minos' love ;

He who struck Ilion's sons with dread dismay,

And he whose radiant chariot brings the day ;

A skilful archer, ever term'd a boy ;

Him Pallas feign'd when Hector fell for Troy ;

B 3

A horse

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A horse (by fame) matcht 'gainst immortal steeds;
 A king by whom his sylvan subjects bleeds;
 An isle, which heaven with trade and commerce blest,
 A cry oft' heard with horror in distress;
 When these initials you have rightly join'd,
 Names a Diarian with true sense refin'd.

I. QUERY, by Mr. E. W. Drosier.

In a clear dry night, if a candle is held near the root of the herb *fraxinella* as it is growing in the garden, a pale flame will immediately surround the plant; which goes off as quick as the flash of gunpowder; this I observed many times last summer, and should be glad to know the cause of such a strange phenomenon?

II. QUERY, by Mr. Samuel Rogers.

How can we account for the heavenly bodies looking so red when near the horizon?

III. QUERY, by Mr. John Langdale, of Kilburn, in Yorkshire.

What was the original of the (once) commonly received opinion of the existence of Fairies?

IV. QUERY, by Mr. Thomas Penfon.

What is the reason, that when a piece of thin India paper is rubbed quick over writing, the letters underneath appear plainer and more distinct than when it is at rest?

V. QUERY, by Sawney Mac Nab.

Required the reason why the itch seldom or never affects the face?

VI. QUERY, by Mr. Edward Wright Drosier.

Whether was Edward Wright or Lord Neper the first inventor of Logarithms?

VII. QUERY, by Mr. John Burrow.

Who was the first inventor of engraving wooden blocks for printing pictures with the letter-press, and at what time, and when was copper-plate printing found out?

VIII. QUERY, by Mr. Reuben Burrow.

Cardan, in his book *De Subtilitate*, gives a short eulogium on Archimedes, Euclid, Apollonius, Aristotle, and some few others of the most learned philosophers and mathematicians of antiquity, and among the rest, he speaks of one *Suiffeth* or *Swiffett*, an Englishman, as a person of the most extraordinary learning and abilities: the eldest Scaliger also, in his book written against the above Treatise of Cardan, *Exercit* 314. p. 982. mentions him in the following terms—*Calculatori Suiffet qui pene modus excessit ingenii humani*. Scaliger also speaks of him in another place with equal respect, and Bishop Wilkins does the same in one of his sermons; he is also several times mentioned with the highest approbation by *Mons. Leibnitz*, who represents him as the first person that applied mathematics to philosophy; and expresses a desire that

New Enigmas.

his works were published. — *Query*, When did this extraordinary person live, and what were the subjects he wrote upon?

IX. *QUERY*, by Miss Lee.

What is the reason, that a fire will not burn so well when the sun shines upon it as at other times?

X. *QUERY*, by Miss Kitty C—.

Why does a person appear smaller in black cloaths than in white ones?

XI. *QUERY*, by Mr. Samuel Penson.

Who was the first person that discovered that the ice of frozen sea water, when dissolved, becomes fresh?

XII. *QUERY*, by Miss Greville.

Is the action of a bow-string upon an arrow, pressure, or percussion, or what is it?

New ENIGMAS to be answered in next Year's Diary.

I. ENIGMA, by Mr. John Clarke, of Lincoln.

When ever I appear in sight,
With me the youth take great delight;
And while they have me in their view,
I run away and they pursue.
Like Harlequin I skip and dance,
Alert as though I came from France.
Go to *Virginia*, there your eyes
May see me of a larger size.
My well-known voice is coarse and full,
I bellow like a Spanish bull,
Yet do no harm,—but often good,
And am to man delicious food.
In physic I am known, some say,
To drive consumptions far away.
My dress is neat—no doubt you'll find
My coat is of the leopard kind;
My shoes and stockings are both yellow;
In short, I am a dapper fellow.
But ladies—can it e'er be told
That I am worth my weight in gold;
And that I render in my station,
The greatest service to the nation.
So say the frugal country wives,
That I preserve some thousand lives;
Keeping their liquor clear and fine,
Well-tasted, rich as Mountain wine.
Happy to do the good I'm able,
Though made the subject of a fable.
And am accused of fullsome pride,
With many other faults beside.

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But this I can aver with truth,
I never yet corrupted youth.
Take one hint more, and you will do't,
By horses I'm trod under foot.

II. ENIGMA, *by Mr. Clarke, of Farnham.*

Ladies, behold your useful servant come
From western climes, and from the earth's dark womb;
With some small art I'm made, and brought to light;
Rough in appearance, yet exceeding bright;
Cylindrical and oval forms I wear,
And sometimes clad in virgin white appear.
Though my acquaintance court me day and night,
There're few come near me but are losers by't;
Yet I with misers small resemblance have,
For much I scrape, yet very little save.
My teeth plac'd on my back are sharp and hollow,
Through which with speed and ease my food I swallow;
Yet soon my scanty meals a passage find,
And leave an aromatic smell behind
But when my features fade and teeth decay,
Like useless baubles I am thrown away.

III. ENIGMA, *by Miss Eliz. Parker, of Norton, Derbyshire.*

While skilful gents, in noble strains,
Invoke the god-like nymphs and swains.
On wings of fame still urge their flight,
To brightest day, through shades of night.
Your female bard in rustic verse,
Scarce dares her sylvan tale rehearse;
But hopes the object will outshine,
The errors that attend the line.
Ere Adam was I took my rise,
And day, by day, approach the skies.
Belov'd of Jove, I dare presume
That I from East, from West, do come.
Of North, and South, I am the pride,
When o'er the deep triumphant ride:
When clarion's sound hails dreadful war,
Each bosom pants to mount the car.
As urg'd by gods cross raging seas,
My off-spring dwell at home in peace.
'Tis hard, you'll say, when at four-score,
To serve a king, nay, fifty more;
Such is my lot, hard is my fate,
O were I in my pristine state!
In shady groves, no sons of May,
Could ever boast such cloathing gay.
This scene of bliss, alas! soon o'er,
Your great protector is no more!
Farewel dear parent fruitful earth,
And to the world declare my worth.

IV. ENIGMA, by Mr. Serjeant Snap, of Havant-Street, Portsmouth.

High on a throne of state 'twixt earth and sky,
 Far from the ken of ev'ry vulgar eye,
 A dreadful tyrant holds his lawless sway,
 Whose mighty *fiat* subject worlds obey;
 And if, in wrath, his vengeful thunder roars,
 Dark hell beneath resounds through all her shores,
 And wretched victims, doom'd to wander there,
 Hide their polluted heads and quake with fear;
 Tremble ye caitiffs! and implore the grace
 Of him the ruin of your realm and race,
 For if his *thumb omnipotent* he wield,
 Whole armies fly, and dauntless heroes yield,
 And mangled carcases bestrew the field.
 In days of yore the pagan world assign'd,
 Of all the favourites of the feather'd kind,
 The daring eagle as the bird of Jove,
 The owl to Pallas, to the queen of love,
 Sweet emblem of herself, the cooing dove;
 So when our wonderous hero mounts his throne,
 And sits supreme, unrivall'd and alone,
 A bird for *wisdom noted most profound*,
 And all his awful ensigns stand around;
 A spear and shield in his right hand borne,
 And *blooming evergreens* his brows adorn.
 Though thus equip'd, the six-legg'd race alone
 His deeds in arms and mighty prowess own,
 For human wights, who most his merits scan,
 Deem him a scrap and fragment of a man;
 And when he moves they mock his awkward gait,
 Or gibing tell of factions in his state.
 His sons, a numerous race, their father's care,
 Hang on his neck the soft embrace to share.
 His daughters too are tenderly care'd,
 Cling round his waist and nestle in his breast;
 Yet, treacherous parricides, his life pursue,
 And in a father's blood their hands embrace!
 Let grey beard stoics arguments produce,
 To prove that virtues stronger grow by use;
 And reverend rogues and holy drawlers say,
 "Use perfect makes, for ever, and for aye;"
 Our sage disputant can by facts enforce,
 That the best *habits* will by use grow worse.
Monbodo, learnedly of late hath shown
 Our hero on four legs, with tail hung down;
 Like *Hooke* he next will shew his race respect,
 First *magnify*, then make them stand erect.

When

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When Morpheus sheds his poppies o'er his head,
 His watchful foes assault him in his bed;
 Fearless and fell, the Legion him surrounds,
 And basely stab him with a thousand wounds;
 His mangled carcase is distain'd with gore,
 And blood distils amain from ev'ry pore;
 Yet those attacks but raise his direful rage,
 Not thousand wounds his courage can assuage;
 For fierce as Samson, up he gets at length,
 And shakes the horrors of his matchless strength;
 Seizes the wretches, after them doth stalk,
 And tears the very ground on which they walk.
 With iron fangs he thousands bites in twain,
 Impal'd on glitt'ring spears are thousands slain,
 Yet thousands and ten thousands still remain. }
 When scoundrel kings and statesmen claim a right
 To tax the very water, smoke and light,
 They find a trick to keep the fools in awe,
 And sanctify their villainy by law:
 Our tyrant's despotism runs more high,
 He taxes you, yet never tells you why.
 When ancient Pagans sacred feastings made,
 They first libations to th' infernals paid;
 'This mystic rite he still retains, some tell,
 And often makes large sacrifice to hell.
 Let rump-fed London wives, who oft complain
 Of measure short, grave citizens disdain;
 Our hero's spouse, more excellently sped,
 Can grasp his yard, and lay it o'er his head.
 Ovid has sung, how some young scoundrel rogues,
 For "being saucy" were transform'd to frogs;
 Custards to city wives, were turn'd they say,
 And gape for white-meats to this very day;
 Our wizard, stranger changes far can show,
 For many an ass he turns into a beau.
 His habitation is exalted high,
 For, eagle like, he soars towards the sky;
 But what most claims the naturalist's regard,
 Is to explain the wonders of his yard,
 Let Crane-Court Soph, who taught the world the arts
 Of drawing sweet and wholesome air from f——ts;
 Let Pringle sage, who did the world enrich
 With wond'rous recipes to cure the itch;
 Or curious Banks, or learn'd Solander show,
 Why men but one, and he and Crabs have two?
 In every age, and every clime, he hath
 Been no less noted for his works than faith;
 Yet all his faith, nor works could e'er controul
 His fate, or save his remnant of a soul;
 For why, his hopes he founds on sons of dust,
 And in great lords and princes puts his trust.

New Enigmas.

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V. ENIGMA, by Miss Bell.

Ladies attend, behold a female strange,
 Who's like your beauteous selves, much given to change;
 And yet, in this, my merits are not small,
 Since I ne'er vary but to serve you all :
 Strange to relate, yet not more strange than true,
 I'm always old, and still am often new;
 Yet my admirers do not find, I'm told,
 More charms in me when new, than when I'm old ;
 'Tis true my husband lends me some assistance,
 Yet, macaroni like, he keeps his distance ;
 And though I try to join him, yet I rather
 Am apt to think, we ne'er shall come together :
 That once we met, philosophers have said,
 To prove it false, alas, I'm still a maid !
 Yet though as chaste as Dian's self can be,
 Some people swear they saw a man in me ;
 But were it so, I've reason sure to roam,
 Because my husband always lies from home ;
 And every night enjoys a noisy cub,
 That gads about, and runs o'er half the globe ;
 And I, not he, of horns am forc'd to wear,
 Two dozen pair at least in every year,
 What British lady would such usage bear ?
 An ass, as men of Gotham tell the tale,
 Once drank me up, like Jonah by the whale ;
 The cuckow-hedgers ript him, for his pains,
 But only found they could not find their brains.
 Should you, the charming rural scenes, persuade,
 To visit Greenwich's calm sequenter'd shade,
 Like lecherous Tom Tit you there might see
 The little Doctor making love to me :
 Or in Moorfields observe the dire alarms
 I give when in my plenitude of charms ;
 And view in secret caves and grotto's there
 What sighs, what tears, what rage, what sad despair,
 What rancorous hate, what rapturous love I cause,
 You'll own my merits more, than your applause.
 In Universities you once might see
 The poring sons of Plato, struck by me ;
 Now; like one of our astronomic blocks,
 Me they neglect to go and get the p — .
 Yet sometimes still, tho' seldom, have I shed
 My virtues o'er the leaden, reverend head ;
 And now with tenfold vigour influence one,
 Styl'd by himself, " the learned Mr. D — ;"
 Exclusive of those dreadful ills and ails,
 That comets cause with *brushing* fiery tails.
 When pious lank-hair'd Wesley first arose
 To twang damnation through elastic nose ;

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And holy Whitfield join'd the dismal cry,
 And rav'd and groan'd, and cock'd his swivel eye;
 Then zeal the tinkers, taylors, coblers fir'd,
 And parsons swore all were by me inspir'd.
 The reverend bench of bishops learnt from me,
 Their perseverance against popery;
 From me the flaming patriots of our day,
 Learn to change sides according to their pay;
 And taught by me, when by his spouse enroll'd,
 The city cuckold tips his horns with gold.

VI. ENIGMA, by Miss Cockbill.

From Cybel's womb I my existence draw;
 Vulcan on me did curious parts bestow.
 The sylvan gods lent aid t' improve my worth,
 Æolus too was present at my birth.
 My midwives were the elements conspir'd,
 M' important name, my origin requir'd.
 I long lay hid, oppress'd with veils obscure,
 But now am seen, immaculate and pure.
 No nymph, posselt of sweet endearing charms,
 E'er hug'd so warm a lover to her arms.
 Let Mira sing, and blooming Daphne say,
 That I have been the theme of many a lay.
 Lucid like Dian', goddess of the chase,
 Boastful, like Pœan, of a radiant face:
 Yet never did my charms move mighty Jove;
 Nor ever in the least wrong Juno's love.
 Yet some Saturnia, of immortal fame,
 Unto the confines of my lodging came,
 Took me from thence; then, with a vivid look,
 She view'd my face, and then my body shook;
 Wrench'd ope' my jaws, my enormous mouth gave way,
 Into my womb——admits the glare of day.
 Sweetly has Ovid sung Semele's fate,
 Slain by Jove's thunder, of the second rate;
 So Argiva did in her right-hand hold,
 A glaring bolt, one of the grosser mould.
 (Artists have doubted, and have often said
 Vulcan ne'er forg'd it, it no Brontes made.)
 Rude, pointed, rough, (tho' by th' Heroine borne)
 And like myself, from Cybel's entrails torn.
 She wav'd the dart, then from her skilful hand,
 Obliquely flew the ever-destin'd brand.
 But I, with pure Vulcanian art well fraught,
 Withstood the shock, the pointed light'ning caught;
 This way, and that, the captive thunders tend,
 With horrid clang, nor can their prison rend.
 Into my face the light'ning darts its heat
 Thro' windings, artful as the Maze of Crete;

Then

Then dragg'd along, thro' æther swift I fly,
 (Like twink'ling stars, hurl'd from their native sky.)
 But stop, for lo! a curious tripos stands,
 Where I am station'd by Argiva's hands.
 Where flow'rs lie drooping, and their charms defac'd
 By rushing waters, or by floods down cast.
 The rose, half faded, and the curling vine,
 Which round the branches of the laurel twine,
 Hang down their heads, and with a drooping look,
 Seem almost dead, nor can the deluge brook.
 There I advance, big with reviving charms,
 Urg'd on by force, compell'd by dint of arms.
 The fainting rose, and every pleasing flow'r,
 Unto their pristine beauties I restore!
 Revive the buds, the drooping blossoms chear,
 Each flow'ry branch my kind influence share.
 And where she deigns, or where I bend my way,
 There all revives and seems a new-born May.

PRIZE ENIGMA (*of 10 Diaries*) by Mr. W. Purver.

Ere polish'd manners to perfection rose,
 And pride, or envy, constituted foes;
 Save where in lively mood, the vocal throng,
 Would boast their powers in contending song;
 A sacred shade arose of goodlier trees,
 Than ever bended to a modern breeze;
 And here, O! hard to tell! a wily cheat,
 With my crude entrails form'd a gross deceit:
 Shame, and despair, now first assail'd the sense,
 And op'd a world, devoid of innocence:
 Soon in succession long dissensions came;
 Dame Nature, solus, could not boast her fame;
 A sister strait was born, and Art her name.

Start not ye rustic train, while I pervade
 Your sun-blest haunt, or cool surrounding shade;
 Nor like Sicilians fly, when Ætna teems
 A fiery deluge, or pernicious steams;
 For I of humbler growth less fear inspire,
 And boast a furnace destitute of fire.

Or hill, or vale, or crystal current shows,
 Some rude material for my future woes;
 For when Pomona, in a fond embrace,
 Selects a blossom from its falling race,
 And grateful *Sol* leads on some happy days,
 And paints its surface with his golden rays,
 Then I appear; a snow-white prison binds
 Some beauteous offsprings, in its close confines,
 Till trusty guards my tender form surround,
 And sling me headlong in a dark profound,
 Where brazen banks, and surging waves abound:
 A dire descent! nor moon, nor stars, appear,
 Yet fowl, and fishes, find a covert here;

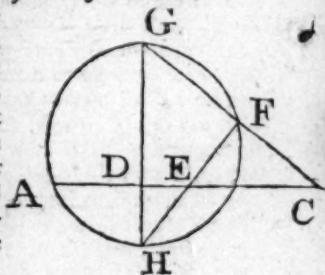
We meet, and part, still meet, again divide,
Like artless pilots, sailing side by side;
Thus while confusion bids the tempest roar,
We rise, and fall, and swim from shore to shore.

Fortune on man bestows her gifts at will,
Alternate, good or bad, or always ill.
Thrice happy he, whose hours are calm, serene,
Nor danger frights, nor care, intrudes between;
To such delightful scenes, I bend my way,
But peace abhors, and flies whene'er I stay;
The noise of arms, the solemn stillness breaks,
And ev'ry breath approaching ruin speaks.
As when th' Athenians, by a god's command,
Gave blooming youth to save a sinking land,
A famish'd monster seiz'd the beauteous prize,
Deaf to complaint, to tears, or doleful cries;
Voracious thus regal'd on noble blood,
The god approv'd, and made his promise good.

Answers to the Mathematical Questions proposed in last Year's DIARY.

I. QUESTION, answered by Mr. J. Merritt,

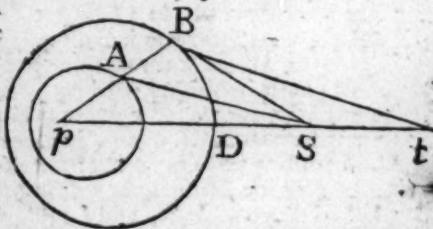
LET GH the diameter of the given circle bisect the given cord AB in D, take cf so that DH is to cf in the given ratio of DE to EF and find the point g, so that the rectangle $cgf = HG D$ then from the point G apply, $GC = gc$ cutting the circle in F and the cord AB produced in C, join HF cutting the cord AB in E and the thing is done.



Demon. By reason of similar triangles $CG : GH :: GD : GF$ the rectangle $CGF = HG D = cgf$ (by construction) but $CG = cg$ $GF = gf$ and $FC = fc$ again by similar triangles $DE : EF :: DH : FC$ (fc) in the given ratio by construction.

II. QUESTION, answered by Mr. J. Merritt,

Let pS be to St as pA to AB , and on St describe a circle to touch the circle BD in B , then pB is the position of the line required.



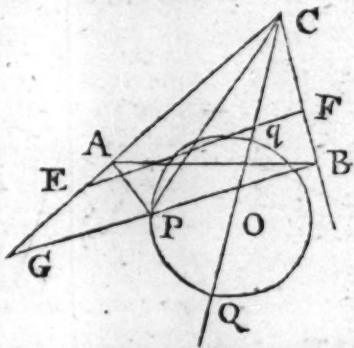
For as $pS : St :: pA : AB$, therefore AS and st are parallel, therefore the angle ASB is equal to SBt ; but SBt is a maximum, therefore the angle ASB is also a maximum.

Answers to Mathematical Questions. 15

In the same manner it was answered by the Proposer, and several others.

III. QUESTION, answered by Mr. Ainsworth.

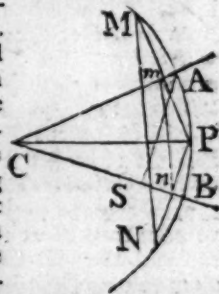
Between CA, CB and \perp to the latter draw EF at such a distance that it may be equal to the line given. Then from C to the given circle apply $CP = CE$, and P will be the point required, for let fall the \perp 's GP, PA, and join AB. Then by reason of the similar triangles BPA, GCP, $AB:CP::GB:GC$. that is by reason of the \parallel 's; $EF:CE$. But $CP = CE$ by construction. Therefore $AB = EF$. Hence it follows, that if CO be drawn through O the centre of the circle crossing it in q and Q, they will be points required for the minimum and maximum values of AB.



Nearly in the same manner it was answered by Messrs. Merrit, Fininley, Pepys, Hedley, Hampshire, Watton, Penfon, and several others.

The same answered by Mr. Samuel Rogers.

Let AB be any circular arc described with the centre C and distance CP, and from any point P therein let fall perpendiculars Pm, Pn on CA and CB, then will mn be constantly equal to AS the sine of the arc AB. For let PN and PM be double of Pn, and Pm, then because the points M and N are in the circular arc, the arc MPN is double the arc AB, and therefore constant, and consequently MN, its chord, is constant, and its half mn; and hence the manner of applying it whether the point P is within or without the angle ACB, or whether the curve be a circle or not is sufficiently evident; for the circle described from the centre C must include or exclude the given circle according as a maximum or minimum is required, and when a given quantity is required, the radius of the circle must be such that the sine of the angle ACB may be equal to the given quantity; the exemplification is needless, as those directions are sufficiently ample: I shall therefore only observe, that the above property will be found useful in constructing several cases of problems relative to four-sided figures.



In this manner nearly it was solved by Mr. Thomas Barker and Mr. William Fininley.

IV. QUESTION,

Answers to Mathematical Questions. 17

V. QUESTION, answered by Mr. William Fininley.

From the question it appears that there are as many stellated angles, as there are angles in the generating figure, because there are as many sides as angles, and each of the sides including any angle of the generating figure meets the opposite side; but the supplement of any particular internal angle of the generating figure, is equal to the two internal opposite angles of the triangle formed by the sides including that angle and the opposite side produced; and as the supplement of each angle of the original figure is equal to two of the saliant or stellated angles, the sum of all the supplements is equal to twice the sum of the stellated angles; but the sum of all the supplements has been proved by Euclid to be four right angles, therefore the sum of the saliant angles is two right angles.

Again; as in all figures of an odd number of sides, there is a side opposed to an angle, so in those of an even number of sides there is an angle opposite to an angle; wherefore, when the number of sides is even, two corresponding sides of two opposite angles may always be taken, forming a saliant angle, and therefore there will be as many of those angles as the figure has sides; but because each two opposite angles may be supposed to be joined, there will be just as many triangles formed as there are saliant angles, or as the figure has sides; each of which triangles has two of its angles composed of part of the opposite angles of the generating or original polygon; and the sum of the angles of all these triangles will be equal to the sum of all the stellated angles, and all the internal angles of the polygon; let n be the number of sides of the original figure; then $2n$ is the number of right angles contained in all the aforesaid triangles, namely, the saliant angles and the internal angles of the polygon; but those of the polygon are equal to $2n - 4$ right angles by Euclid; therefore $2n - (2n - 4) = 4$ right angles, the sum of all the saliant angles in the even sided figure.

Nearly thus, this Question was answered by the Proposer; it was also answered differently by Mr. Samuel Oliver, Messrs. Merritt, Hampshire, Smith, Barker, Rowe, Walker, and several others.

VI. QUESTION, answered by Mr. Jeremiah Ainsworth.

Let AB represent the position of the stick, and C its centre of gravity: Then since the action of the hand is not to give it any angular motion, it must act in the direction of the stick itself. Let it therefore be represented by CB, let fall BE \perp to the horizon meeting CE drawn parallel thereto in E, and complete the parallelogram BEDC. Then, since the motion is to be an horizontal one, it is evident CD must be the force of gravity or weight of the stick, and CE the uniform accelerative force, compounded of the two former, acting parallel to the horizon. — Hence if we put $a = \text{tangent of } \angle CBE$,



C

E, $b =$

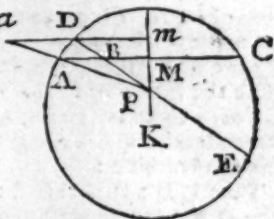
Answers to Mathematical Questions. 19

than taking that arch in the primitive and from its end letting fall \perp 's to B F. Moreover, the pole will be in P E produced and at a distance from E equal to the length of a line drawn from N \perp to N E terminating in the circumference of the primitive circle.

* * The three following Problems were set up last year and omitted for want of room; we shall here subjoin them as they relate to the same subject, and are very useful.

P R O B L E M I.

ADE is the given circle, and DE a given chord; required to draw AC parallel to D m, a line given in position, meeting DE in B so that AB shall have a given ratio to BC, viz. the ratio of m to n .

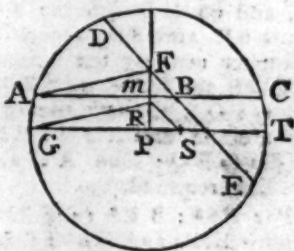


Draw K m perpendicular to D m meeting AE in P, and produce m D to a so that $a D : a m :: 2 m : m + n$, then join $a P$ meeting the circle in A and draw AC parallel to D m which is the line required.

For $AB : AM :: m : \frac{1}{2}(m + n)$ but $AM = \frac{1}{2}(AB + BC)$
 $\therefore AB : AB + BC :: m : m + n$ and consequently $AB : BC :: m : n$.

The same otherwise.

Let ADE be the circle and DE the given chord; draw the diameter GPT parallel to the line given in position, and the radius PF perpendicular to it, meeting DE in F; divide GT in S so that GS may be to ST in the given ratio of AB to BC, and draw SR parallel to DE meeting PF in R; join RG and draw FA parallel to it meeting the circumference in A, then AC drawn parallel to GP is the line required.



For the triangles AFB and GRS are similar by construction; therefore $GP : PS :: AM : m B$, consequently $GP + PS : GP - PS :: Am + m B : Am - m B$, that is $GS : ST :: AB : BC$.

The construction is exactly the same when the point B falls without the circle.

P R O B L E M II.

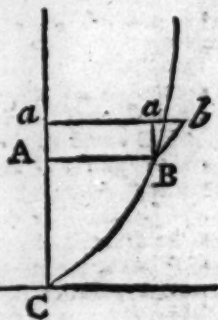
AC and DN are two diameters in a given circle, meeting in a given angle, in which there are two given points P and B; it is required to draw ac and dn parallel to AC and DN, meeting in b , so that $AP : PC :: ab : bc$ and $DB : BN :: db : bn$.

C 2

Analysis.

Answers to Mathematical Questions. 21

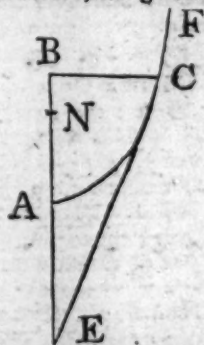
represent the angular velocity of the point B; and $\frac{y^2}{a^2 y}$ or $\frac{y}{a^2}$ the centrifugal force in the direction AB. But $\frac{y}{a^2} \times \frac{\dot{y}}{z}$ will represent the same force in the direction Bb, or that of the curve which, per Question, must be equal to the force of gravity in a contrary direction. Put $g = 32\frac{1}{6}$ and the force of gravity will be represented by $g \times \frac{x}{z}$ equal to $\frac{y}{a^2} \times \frac{\dot{y}}{z}$. The fluents of which being taken, &c. we have $2 a^2 g x = y^2$, an equation to the common parabola, &c.



This Question was also answered by Mr. Edwards.

The same answered by Mr. Ainsworth.

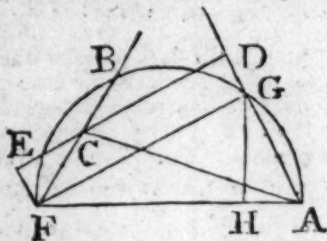
If a parabola ACF be described, with its axis AB \perp to the horizon, and whose parameter AN has to 1 foot, the given ratio that the globe's weight would have to its centrifugal force, if made to revolve in a circle 1 foot diameter, with the given angular velocity. Then the required figure of the cylindrical tube will be had.—For let C be any position of the globe, BC \perp to AB, and CE a tangent to the parabola at C.—Then since the angular velocity being given, the centrifugal forces are as the radii, it follows from thence and the construction, that AN will be to 2 BC as the globe's weight to its centrifugal force when at C, but CE : BC as the centrifugal force, is to its power to force the globe up the inclined plane EC, consequently $AN \times CE : 2 BC^2 = AN \times 2 AB$ or $CE : 2 AB = BE ::$ globe's weight to the power of the centrifugal force to make it move up the curve.—Now from the nature of the inclined plane EC, it follows that CE : BE :: globe's weight is to the force with which it tends to descend down the curve by its own weight.—These two forces are therefore equal and contrary, and consequently the globe will remain at rest. Q. E. D.



In looking over the IX. Question (which by a mistake was put under the name of the Rev. Mr. Crakelt) we discovered a mistake in the proposer's solution, which was not observed when the question was inserted, nor till it was too late to re-consider it.

X. QUESTION, answered by Mr J. Merritt.

Let $\angle ACB$ be the given angle, AC equal to one of the given radii, and produce BC to F so that $CF =$ the other, then join AF , and upon AF describe a semicircle, then draw HG perpendicular to AF cutting the semicircle in G , so that the rectangle $AF \times HG$ equal to the given magnitude; join FG and through the point C draw CD parallel to FG and the thing is done. For let AG be drawn and produced to meet CD in the point D , and let FE be drawn parallel to AD and DC be produced to meet FE in E . Then since $\angle AGF$ is a right-angle (by construction) $\angle ADC$ and $\angle CEF$ are right-angles by reason of parallel lines, and $\angle A$ and $\angle F$ equal the given radii $\therefore AD$ is the sine and DC is the cosine of the angle ACD ; again, FE is the sine and CE the cosine of the angle FCE equal the angle BCD \therefore it is evident that AG is equal to the difference of the sines AD and FE and that $FG = DE$ is equal to the sum of the cosines DC and CE , moreover the rectangle $AGF = AF \cdot HG$ equal to the given magnitude by construction.



This Question was answered by several others.

XI. PRIZE QUESTION, answered by Mr. Jeremiah Ainsworth.

Suppose a die having 36 faces of 12 different sorts, namely, 1 (*a*) of them marked 2, 2 (*b*) marked 3, 3 (*c*) marked 4, 4 (*d*) marked 5, 5 (*e*) marked 6, 6 (*f*) marked 7, 5 (*g*) marked 8, 4 (*h*) marked 9, 3 (*i*) marked 10, 2 (*k*) marked 11, and 1 (*l*) marked 12. Then, it is evident, that throwing this one die, will be equivalent to throwing two common ones, as it has the same number of chances for throwing any one number. Now if we enquire what the chance is that of n throws with this die, they shall come up every one different, and none of them 7, but that

the $\frac{n}{n+1}$ shall be 7. The multinomial $a+b+c+d+e+f+g+h+i+k+l$ must be raised to the n^{th} power, and those terms of it be selected, in which are only one letter of a sort (the coefficients of which will be 1. 2. 3. . . . n) for the numerator, to

the denominator 36^n — then this multiplied by $\frac{1}{6}$ the chance for

the $\frac{n}{n+1}$ throw being 7, will give the thing wanted. But as it would be very troublesome actually to raise that multinomial to the powers required. It may not be improper to make use of an expedient to facilitate the calculation of the particular terms wanted. — Thus let an equation be formed by the continual multiplication of $z+1, z+2, z+3, \&c.$ that its roots may be $a, b, c, \&c.$ to l respectively, and the coefficient of the first term will

Answers to Mathematical Questions. 23

will be found 1, of the 2d $P = 36$, of the 3d $Q = 395$, the 4th $R = 3000$, the 5th $S = 14523$, the 6th $T = 46710$, the 7th $U = 100805$, the 8th $V = 143700$, the 9th $W = 129076$, the 10th $X = 65760$, and the 11th $Y = 14400$.—Then is P, Q, R , &c. the sum of the terms (but without coefficients) that are to be selected out of the multinomial when it is raised to the 1st, 2d, 3d, &c.

powers; consequently $\frac{P}{36} \times \frac{1}{6} = \frac{5}{36}$ is the chance that the

first throw is not 7, but that the 2d is $7 - \frac{2Q}{36^2} \times \frac{1}{6} = \frac{4740}{36^2}$

= chance the 1st and 2d are not alike, nor 7, but that the 3d is $7 \cdot \frac{2 \cdot 3 R}{36^3} \times \frac{1}{6} = \frac{3000}{36^3} = D^o$. . 1, 2 and 3 are no two alike, nor 7,

but that the 4th is $7 \cdot \frac{2 \cdot 3 \cdot 4 S}{36^4} \times \frac{1}{6} = \frac{58092}{36^4} D^o$. . 1, 2, 3 and 4

are no two alike, nor 7, but that the 5th is $7 \cdot \frac{2 \cdot 3 \cdot 4 \cdot 5 T}{36^5} \times \frac{1}{6}$

$= \frac{934200}{36^5}$ = chance for winning by the 6th throw $\frac{2 \cdot 3 \cdot 4 \cdot 5 \cdot 6 U}{36^6} \times \frac{1}{6}$

$\frac{1}{6} = \frac{12096600}{36^6} = D^o$. by the 7th, $\frac{2 \cdot 3 \cdot \dots \cdot 7 V}{36^7} \times \frac{1}{6} = \frac{120708900}{36^7}$

D^o . 8th. $\frac{2 \cdot 3 \cdot 4 \cdot \dots \cdot 8 W}{36^8} \times \frac{1}{6} = \frac{867390720}{36^8} D^o$. 9th. $\frac{2 \cdot 3 \cdot 4 \cdot \dots \cdot 9 X}{36^9} \times \frac{1}{6} = \frac{110476800}{36^9} = D^o$. 10th. $\frac{2 \cdot 3 \cdot 4 \cdot \dots \cdot 10 Y}{36^{10}} \times \frac{1}{6} = \frac{6720000}{36^{10}}$

The sum of all which, being added to $\frac{1}{6}$ the chance

for the first throws being 7 gives $\frac{1942942141}{3673320192}$ the probability re-

quired.

Hence the odds are *exactly* 1942942141 to 1730378051, or nearly 9 to 8, or more nearly 64 to 57, that 7 comes once before any other number comes twice.

PRIZE QUESTION, answered by Mr. C. H. Badger.

Put a = the chance of throwing 7 at one throw = 6, s = sum of the chances of all the other throws = 30, $b, c, d, e, f, g, h, i, k$ = sum of the products of every 2, 3, 4, 5, 6, 7, 8, 9, 10. chances of such throws, respectively.

Then the sum of all the chances in one throw = $a + s = 36 = a^2$. Now a = the chance of throwing 7 the first throw, is all the chance of determining the bet the first throw, s = sum of the chances of all other throws, being so many undetermined chances, and with these s chances another trial is to be made; then sa = the chance of throwing 7 the second throw, and not the first,

C 4

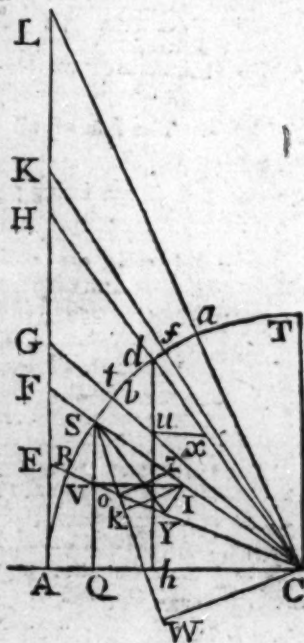
which

which added to $a \times a^2$, or the chance of throwing 7 the first throw multiplied into the whole number of chances in one throw, makes $a^3 + sa$ = chance of throwing 7 in two throws, a^4 being the whole number of chances, and it is evident that $2b$ will be = number of undetermined chances after the second throw, with which a third trial is to be made; then multiplying $a^3 + sa$ by a^2 , and $2b$ by a as before, we have $a^5 + a^3s + 2ba$ = chance of throwing 7 in three throws and no other throw twice, a^6 being the whole number of chances, and $2.3c$ = the number of undetermined chances after the third throw; proceeding in this manner for eleven throws, in which the bet must be determined, we shall have the chance of throwing 7, and no other number twice, to the whole number of chances in eleven throws, as $a^{21} + sa^{19} + 2ba^{17} + 2.3ca^{15} + 2.3.4da^{13} + 2.3.4.5ea^{11} + 2.3.4.5.6fa^9 + 2.3.4.5.6.7ga^7 + 2.3.4.5.6.7.8ha^5 + 2.3.4.5.6.7.8.9ia^3 + 2.3.4.5.6.7.8.9.10ka$ to a^{22} which being reduced to the least term in numbers will be as 1942942141 to 3673320192, whence the chance of throwing 7 before any other number comes up twice will be as 1942942141 to 1730378051. Q. E. I.

No other Answers to the Prize Question but those two having been received, Messrs. Badger and Ainsworth are desired to accept of Twelve Diaries each; which may be had by sending to the Publisher.

The following elegant Demonstration of Baron Maseres's Theorem, was received last Year from the Rev. Mr. Crakelt, but came rather too late to be then conveniently inserted.

Demonst. Let AS and AR, Aa and Af, be four arches, whose equal differences, RS and fa, are equidistant from the middle point, t, of the quadrant CAT, and let AF and AE, AL and AK, be the corresponding tangents: then the triangles, ACL and ACE, ACK and ACF, being similar, we shall have $AL : AC :: AC : AE$, and $AK : AC :: AC : AF$; and consequently, *ex aquo perturbatè*, $AL : AK :: AF : AE$. Now let Ad and Ab be any two other arches, having their difference, bd, equal to RS, but nearer the point t; and let AH and AG be their tangents: also on AC let fall the perpendiculars db and SQ, cutting Cb and CR in u and V, cutting Cd and CS in x and I. — make the angle CSY equal to the angle ACR, and upon CS constitute the trian-



Answers to Mathematical Questions. 25

gle CWS equal to the triangle Cbd . Then the $\angle ISY$ being (by construc.) = the $\angle ACR$ = (by Euc. I. 29.) the $\angle IVY$, as IVS is a right-angle, a semicircle may be described through the four points, $IYVS$; in which case, as the $\angle CSW$ or Cdb or CHA is (by Euc. I. 16.) greater than the $\angle CLA$ or CSV and less than the $\angle CFA$ or CSQ , SW will cut CR betwixt V and Y ; let it cut it in the point o , which will necessarily be within the aforesaid semicircle, and erect the perpendicular oz (to SW) meeting CS in z ; and then, by Euc. I. 26. So will be equal to du , and Sz to dx : but, if the semicircle on IS be supposed to cut SW in k , and Ik be drawn, as Sk is greater than So , by similar triangles SI will be greater than Sz , and CI less than Cz ; and consequently the ratio of CS to CI or of QS to QV or of AF to AE will be greater than the ratio of $CS = Cd$ to $Cz = Cx$ or of pd to bu or of AH to AG , and *vice versa*.

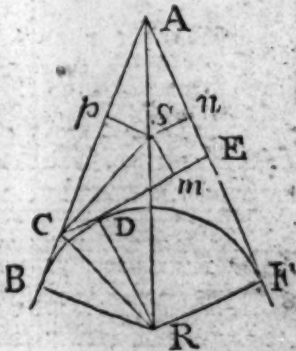
ARTICLE XX.

Additions and Corrections to the preceding DIARIES.

IN the Diary for 1776, page 31, PROB. I. If "Logarithms" be written instead of "Log fines" the rule then serves for right-lined triangles. In p. 29, last line, the second term of the proportion should be Z ; p. 36, l. 14, for PM , read Pm ; p. 38, after Lemma 2. add, "If the rectangle PAC be required to have a given ratio to PNC , the construction will be the same, except in taking Ca^2 in the same ratio to $sn \times nr$; p. 42, l. 39, for RS , read RPS ; p. 42, l. 41, after "position," add, "passing through the given point; p. 43, l. 35, add, "circle."

In the Diary for 1777, p. 25, fig. 2. the curve ME should touch IG in G ; p. 36, cor. 3, for $\frac{1}{2}$ read $\frac{1}{2}a$; p. 30, l. 6, for "half the square of the radius," read "square of half the radius;" p. 30, l. 21, for " RCS " read " RSC ." After the Problems in p. 35, add the following:

$AB = Ap + Cm + Em$, and $AC = Ap + Cm$, therefore $AB - AC = Em$, and $BC = Em = CD$, and $Cm = ED = EF$; also $Bp = CE$, for $Cp = Cm$ and $CB = Em$, therefore $Bp = CE$: Hence to draw a line CE to touch the circle of a given length, take Bp of the given length; draw $ps \perp$ to Ap meeting AR in s , describe a circle with radius sp and also draw CDE to touch both circles. Again, because RCs is a right-angle, the angle $pCs = CRD = CRB$ therefore by similar triangles, $ps :$



$pC :: CD : DR$, that is, $ps : Cm (DE) :: CD : DR$ or alternately $ps : CD :: DE : DR$; and hence a tangent CE may be drawn so that $CD \times DE$ may be equal to a given square, by taking ps a third proportional to DR and the side of the given square and from the centre s with this distance, describing a circle, and drawing CE to touch both circles; and hence if the perimeter, the vertical angle and the rectangle of the segments of the base made by a perpendicular let fall from the centre of the inscribed circle upon the base be given, the triangle may be constructed; for $Cm \times mE = CD \times DE$.

In p. 39, for Prop. VIII. and IX. read IX. and X. p. 40, l. 44, for Cm read Cd . In Article XIII. there are several press errors, and perhaps in other places which the reader may easily correct; p. 47, Quest. XVII. instead of the difference of AD and DC , read AD minus DC .

In the Diary for 1778, p. 37, l. 3 bot. for CP , read BC ; p. 40, l. 28, for HKC read HKE ; p. 43, Cor. 2. for a , read a^2 ; p. 44, l. 1, for $a + \frac{1}{3}N$ and $N + \frac{1}{3}a$, read $a^2 + \frac{1}{3}N$ and $N + \frac{1}{3}a^2$; and after Cor. 2. add, "Hence three times the nearest square added to the given number, is to the difference between the given number and the nearest square, as twice the root of the nearest square to the correction; to be added or subtracted according as the nearest square is less or greater than the given number. Page 46, after Article XVI. add, "By supposing a pendulum, or weight, suspended by a thread fastened to the point that describes the track of the shell, and passing through a hole, and set a vibrating; then the curve that the pendulum describes when it is drawn up by the motion of the aforesaid point may be described on a plane in a manner similar to that of the track, and by means of this curve which will be thus given, the relative velocity of the ball in any part of the track may be determined."

In the Diary for 1779, p. 22, l. 26, for "three fifths," read "four fifths;" p. 32, l. 4, for $1 + r$ read $1 - r$; l. 17, for $-2m$ read $-2m : \times m^2$; l. 15, for $m = 2$, read $m = 2$; l. 17, for $4m^2$, read $5m^2$; p. 38, l. 9, for COI , read cOI ; p. 39, l. 34, dele "other;" p. 40, fig. the points PA must be joined meeting EN in W ; p. 46, l. 16, for 7, read 2; p. 47, Quest. I. for "bisect the diameter," read "be bisected by the diameter." p. 48, Quest. XLIX. for "by the Rev. Mr. Crakelt," read by Mr. John Burrow."

The following Note relates to Article XIV. Diary 1778.

In some discourse which I formerly had with the late Mr. Robertson, Librarian of the Royal Society, he happened accidentally to make mention of several pieces that he wrote and gave Mr. Dodson, among which he particularized the first volume of the *Mathematical Repository*, published under Dodson's name; the Precepts and Examples, &c. to the *Antilogarithmic Canon*, and "that Rule for extracting the cube root by proportion, which (he said) was given about:" Now, as what was first said relative to the *Repository* engaged my curiosity at that time the most, I paid

little attention to the last, till some time afterwards; when Mr. Reuben Robins happening to mention that "*he had a rule for extracting the cube root by proportion, which nobody had demonstrated, and which was given him by Mr. Dodson, to whom he went to school;*" I recollected what Mr. Robertson had formerly said; and after demonstrating the rule, set about investigating a general method for finding similar ones; from whence I readily deduced Mr. Robertson's rule, and many others of my own for the square, cube, fifth and higher roots; a specimen of which method I gave in the Article aforementioned; but as Mr. Robertson's had little or no advantage over the usual rules, on account of the necessity of repeating a tedious operation through every figure of the quotient over and over, in performing the divisions, besides the same labour in each multiplication; I forbore to mention his name in that Article, and the more so as Mr. Robins seemed then very positive in ascribing the rule to Dodson, for which I thought he might have more reasons than I now find he has, and therefore I confined myself solely to the manner of investigation, without giving any other results there than what were just sufficient to exemplify the method: but having often occasion to teach the cube root to those that learn gunnery, to save myself trouble, I inserted in the preface to a small treatise on projectiles, one of my aforesaid rules, by which the cube root may be extracted in about one third part of the time that the other rule takes; and having observed that Mr. Hedley in his treatise of Arithmetic, has ascribed Mr. Robertson's rule to me (though mine is very different in effect, notwithstanding both may be easily derived from each other) I thought proper to give a particular account of the affair that it may be known which rules are mine, and which rule is not, and to shew that the first hint of considering the matter was owing to Mr. Robins. R. B.

A correct Answer to the 12th Question, by Mr. Ainsworth.

By the remark to the 20th Problem of De Moivre's Doctrine of Chances, find the chance the dealer has for having precisely x , the eldest r , the next s and the other $t (= 13 - x + r + s)$ trumps respectively. Thus, when $n = 51$, $a = 12$, $c = 12$, $p = x - 1$ and $d = 39$, $12. 11. 10 (x - 1) \times 39. 38. 37 (13 - x) \times \frac{12. 11. 10}{1. 2. 3}$

$\frac{51. 50. 49 (12)}{13. 12. 11 (r) \times 26. 25. 24. (13 - x - r) \times \frac{13 - x}{1} \times \frac{12 - x}{2} \times \frac{11 - x}{3} (r)$

$\frac{29. 38. 37 (13 - x)}{=}$ the chance to first has r trumps precisely, the former circumstance

Circumstance being considered as completed. — Lastly,
 $n = 26$, $a = 13 - x - r$, $c = 13$, $p = s$ and $d = 13 -$
 consequently $13.12.11(s) \times 13.12.11(13 - x + r + s)$

$$\frac{13 - x + r}{1} \times \frac{12 - x + r}{2} \times \frac{11 - x + r}{3} (s)$$

$$26.25.24(13 - x + r).$$

= the chance for the 2d having s trumps, — Wherefore the
 the product of these three, viz. $12.11.10(x + r + s - 1) \times 13.12.$

$$11(13 - x + r + s) \times 12.11.10(x - 1) \times 13.12.11(r) \times 13.12.11(s)$$

$$51.50.49(12) \times 1.2.3(x - 1) \times 1.2.3(r) \times 1.2.3(s)$$

will be the chance that the dealer has x , the eldest r , the next s ,
 and the youngest t trumps precisely. Consequently that expres-
 sion being multiplied by the permutations of the three quantities
 r , s and t , taken all at a time, will give the chance that the dealer
 has x trumps, and that some one of the other three have precisely
 r , another s and a third t trumps, — by which expression the
 numbers in the following table may be readily calculated, for
 seeing that some of the factors will be common, we may very
 much contract the operation by proceeding thus: Make $M =$
 $12.11.10(8) \times 13.12(4)$, and $A = \frac{13.12.11(4) \times 13.12.11(4)}{1.2.3(4) \times 1.2.3(4)}$

$$51.50.49$$

$$1.2.3(4) \times 1.2.3(4)$$

Then will $B = \frac{48}{10} A$, $C = \frac{3}{2} B$, $D = \frac{44}{30} C$, $E = \frac{4}{3} C$, $F = \frac{7}{8} E$
 and $G = \frac{44}{30} F$, and therefore $A + 3B + 3C + 3E + 6F + G$
 $\times M$ is the chance required.

x	r	s	t	Permu- tations			
1	4	4	4	1	A		.511225
2	3	4	4	3	B		2463880
3	2	4	4	3	C		3680820
	2	4	4	3	D		5398536
	3	3	4	3	E		2044900
4	1	4	4	6	F		4907760
	3	3	4	1	G		7198048
							Sum 77820241

The first column exhibits the different values that x may have,
 and the second, the values that r , s and t may have at the same
 time. The third number of permutations of r , s and t ; the
 fourth, the names of the numbers in the sixth; the fifth is M , a
 common multiplier, the sixth calculated as above, and the seventh,
 the product of the third and sixth columns. — The sum of all
 the

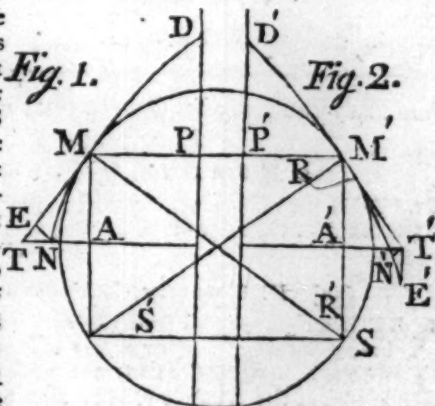
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the numbers in the last column, viz. 77890241 being multiplied by
 $M = \frac{143}{31750677980}$ gives $\frac{11138304463}{31750677980} =$ the chance for none of
 players having 5 or more trumps, wherefore the required odds is
 exactly 11138304463 to 20612373517, or nearly 7 to 13.

ARTICLE XXI.

A Method of finding the common Expressions for the Radius of Curvature. By E. C.

FIRST, Let DMN be the curve DP its axis PM its ordinate, and let the fluxion of DP or x be constant, also let MS be the diameter of the circle of curvature, $R =$ its radius, as in the figure and MT a tangent to the curve at MT being indefinitely near to M, then $TN = -\frac{1}{2}\dot{y}$
 $TE = -\frac{1}{2}\ddot{x}$
 then $MA : MT :: MR : MS$
 and $TN : MT :: MT : MR$
 by the property of the circle.



Wherefore $MA \times TN : TM^2 :: MT : MS$

$$\therefore R = \frac{1}{2} MS = \frac{MT^3}{MA \times 2TN} = \frac{\dot{x}^3}{-\dot{y}\ddot{x}}$$

But $TN : TM :: TE : TA \therefore R = \frac{MT^2 \times TA}{MA \times 2TE} = \frac{\dot{x}^2 \dot{y}}{-\ddot{x}\dot{y}}$

Secondly, Let the fluxion of PM be constant (see Fig. 2.) and take $MN = MT$.

Then $TE = \frac{1}{2}\ddot{x}$ $EN = \frac{1}{2}\ddot{y}$

$TE : TM :: TM : MR$

$TA : TM :: MR : MS$

Wherefore $TE \times TA : TM^2 :: TM : MS$

$$\therefore R = \frac{1}{2} MS = \frac{TM^3}{TA \times 2TE} = \frac{\dot{y}\dot{x}^3}{\ddot{y}\ddot{x}}$$

But by similar triangles $TE : TM :: EN : MA$

Therefore $R = \frac{TM^2 \times MA}{TA \times 2EN} = \frac{\dot{x}^2 \dot{y}}{\ddot{y}\ddot{x}}$

Thirdly,

New Mathematical Questions.

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their planes perpendicular to the horizon, and "making a given angle with" the meridian; it is required to determine at what time of the day on June 21st the latitude of 55° , their shadows will cover the greatest quantity of land possible.

[57] VI. QUESTION, by the Same.

SUPPOSE at the arctic circle, a pole 20 feet long erected perpendicular to the horizon; it is required to find at what time of the day on June the 21st the summit of the shadow will be the nearest possible to a pin fixed three feet to the west from the bottom of the pole?

N. B. The three foregoing questions, together with some others, by our late regretted correspondent, were communicated by his friend the ingenious Mr. Hedley, who has just published a new treatise on Arithmetic.

[58] VII. QUESTION, by Mr. C. H. Badger.

INSCRIBE the equilateral triangle ABC in a circle; assume the point M in the circumference at pleasure, and making the arc AN double the arc AM, draw the chord MN cutting the sides of the triangle (produced if required) in P, Q and R; draw the chord mn equal and parallel to MN, cutting the sides of the triangle (as before) in p , q and r ; put radius equal to unity, and MN or mn equal to c ; then I say, the lines MP, MQ and MR will be expressed by the three values of x in the equation $x^2 + 6cx - c^2 = 0$; likewise the lines mp , mq and mr will be expressed by the three values of x in the equation $cx^3 - c^2 = 0$; required the investigation.

[59] VIII. QUESTION, by Mr. Thomas Todd.

Determine what forces of gravity must obtain, to make the cycloid, circle, parabola, ellipse and hyperbola, curves of steepest descent; supposing gravity to act in parallel lines.

[60] IX. QUESTION, by Mr. Thomas Moss.

TO or from two given right lines, it is required to add or subtract two others in a given ratio, or to add the one and subtract the other, so that the rectangle of the two lines thus compounded may be equal to a given square.

[61] X. QUESTION, by Mr. Jeremiah Ainsworth.

IT is required to exhibit in finite terms, exclusive of circular arcs and logarithms; the whole fluent of $\frac{z}{\sqrt{6az - a^2 - z^2}}$ generated while z from being $= (3 - 2\sqrt{2}) \times a$ becomes $= 0$, in which case $\sqrt{6az - a^2 - z^2}$ from 0 becomes $= 2a$?

[62] XI. QUES-

The Ladies Diary.

[62] M. QUESTION, by Mr. J. Edwards.

SUPPOSE a right cylinder whose length is 12, and diameter 10, is struck by a ball moving along that axis with a velocity of ten feet per second; required the greatest angular velocity of the axis of the cylinder which the moving body can communicate, supposing the bodies non-elastic, and the direction of the stroke parallel to the plane and passing through the axis.

[63] XII. QUESTION, by Mr. Reuben Burrow.

GIVEN three altitudes of the sun and the two intervals of time to find the latitude of the place and the sun's declination, &c. by construction.

[64] XIII. QUESTION, by Rev. Mr. Crakelt.

GIVEN the vertical angle of a plane triangle, and the sum of its base and perpendicular, and the radius of its inscribed circle; to determine the triangle.

[65] XIV. PRIZE QUESTION.

IF there be an infinite number of circular arcs, the sines of which are found by substituting the series of natural numbers

1, 2, 3, &c. in the general expression $\frac{\sqrt{n \cdot n + 2} - \sqrt{n + 1 \cdot n - 1}}{n \cdot n + 1}$

then will the sum of this infinite series be equal to the quadrantal arc of the circle: required the investigation.

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